

Hydrogeologic Site Characterization and Well Testing

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Introduction

Sandia National Laboratories' Defense Waste Management Programs (DWMP) uses a combination of field systems, software and scientific expertise to perform characterization activities. Capabilities include groundwater testing and hydraulic response analysis to assess and understand subsurface conditions at a particular site or region.

Hydrology as part of the Site Characterization

Whether you are looking to site a petroleum production well, locate a new business, or select a site for a nuclear repository, a thorough understanding of the hydrology and geology of a site is an essential part of the Environmental Assessment which may be required to move forward with a project. These assessments typically require a hydrologic component which includes a demonstrated understanding of the current hydraulic conditions and the long-term impact(s) a new activity may have on the region's hydrology. DWMP has developed several field test systems and analysis software that can provide the data necessary to model and document the hydrologic properties for a specific area.

Understanding the Groundwater System

Using various custom designed test trailers, DWMP can implement a suite of hydrologic testing methods to characterize the groundwater in a

selected geologic formation. These test methods include pneumatic and solid slug withdrawal/injection tests



Custom Designed Test Trailers

and constant rate flow tests in wells that range from 10 to 1200 feet in total depth.

Constant rate flow tests can be performed utilizing computer controlled flow rates ranging from 0.2 gallons per minute (gpm) to 1500 gpm, with better than 0.1% flow control. The testing trailer equipment can support tests that range from hours to weeks and include real-time monitoring and continuous data collection of water quality parameters, water levels and flow rates which can be correlated with the volume of water extracted from the testing well.

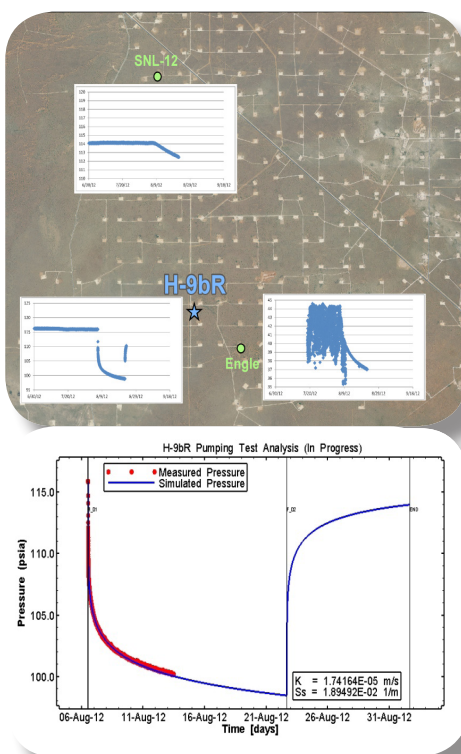
Active testing is augmented with the implementation of a network of instrumentation to continuously collect water level and pressure response data across a region. This information is a fundamental part of establishing an understanding of long-term trends and impacts on a region's water resources. The data are then analyzed to develop correlations with inputs to the system including precipitation, barometric pressure and earth tides.



Well Test Setup

Designing and Conducting Better Tests Utilizing Real-Time Data Analysis

DWMP's pumping test and data interpretation capabilities provide on-site, real-time analysis of hydraulic testing events. DWMP's field hydrology testing systems incorporate multiple water level and flow data acquisition systems for both the testing well and identified observation wells in the selected area. The pressure response, water level, and flow data are analyzed during the test using nSIGHTS, a DWMP developed well-test analysis software



Real-time Analysis

package that has a quality assurance pedigree accepted for use at nuclear repository sites.

Real-time analysis allows adjustment of applied test parameters (i.e. pumping rate) to compensate for unknowns associated with subsurface hydrology. We perform real-time

optimization and adjustment of test parameters and objectives if the prior knowledge of the subsurface appears inadequate. DWPG's well-test analysis also provides on-site estimates of hydraulic parameters, such as hydraulic conductivity specific storage and dual-porosity characterization. A more complete analysis of the data conducted once adequate recovery data are collected including uncertainty analysis.

Geology and Geochemistry Support Groundwater Characterization

In order to fully characterize the hydrology in an area, correlation of hydrology with the subsurface geology is essential to fully understand the available water resources and to characterize the hydrology of the area. DWMP has developed systems and processes that characterize geologic formations and their impact on the hydrology in a region. This is accomplished by utilizing standard geophysical methods and correlating the measurements and results with comprehensive video-logs of boreholes and wells along with the results of geochemical analyses performed on produced waters. DWMP utilizes portable sampling equipment that can collect samples from depths up to 1800 feet and borehole video cameras that can reach depths of 2000 feet and enter boreholes that range in diameter from approximately 2 to 24 inches. The video images can be recorded from both horizontal and vertical views and can include a full 360 degree observation window.



Inside and Outside of Video Logging Trailer

References

- Bowman II, D.O. and Beauheim, R.L., Analysis Report for AP-070: Analysis of Magenta Hydraulic Tests Performed Between December 1978 and June 2009, Sandia National Laboratories, ERMS 550906, 2010.
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For more information, please contact:

Michael Schuhen
Email: mdschuh@sandia.gov
Phone: (505) 284-5363
Website: energy.sandia.gov